DISTRIBUTION OF NON-HYDROCARBON GASES IN CENTRAL INDUS BASIN-PAKISTAN

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Central Indus Basin is the most prolific gasproducing ba~in in the sub-continent, and is unique in the sense that it has produced only dry gas with ver) little condensate. Eocene and Cretaceous rocks are the main reservoirs in this basin. More than 1 TCF of carbon dioxide (CO_2) and nitrogen (N_2) are estimated to be present as contaminants (N_2 being more than 50%) of total about 2 TCF gas reserves. The maximum concentration of CO_2 is about 60-70% at Kandra-1 / Khairpur-2 and of N_2 about 42 % at Badar - I. High CO_2 contents are sometimes accompanied with high N_2 (Khairpur-2 and Uch) but generally there is no obvious relationship between N_2 and CO_2 contents. Isotopic analysis of gas samples from Sui and Kandhkot wells suggest that CO_2 is mainly derived from thermal decomposition of carbonates. Whereas, high proportion of N_2 might have been contributed from thermal breakdown of organic matter in late mature source rocks.

The high accumulations of inerts has a great impact on the prospectivity and the economics of the discoveries. Contaminated reserves of more than 2 TCF have remained undeveloped since their discovery due to higher percentage of non-combustible gases associated with hydrocarbon gases. Exploration areas around such fields have been considered to carry high risk for exploratory drilling since it has been taken for granted that any gas discovery in such vicinities will also contain abundant inert gases and make any discovery in the area uneconomical. However, recent drilling in Block-22 (north of Jacoba bad-Khairpur High) by Pakistan Petroleum Limited (PPL) and the data from offset wells suggest that the occurrence of these gases is not ubiquitous. Concentration of CO_2 in three exploration wells drilled in Block-22 was much lower (N_2 =32% & CO_2 =2.5 %) than anticipated based on regional projections. Historically, this block was considered to be uneconomical on the basis of gas quality in view of its proximity to the Khairpur and Kandra wells.

Present study denotes that the vanatton in the distribution of CO_2 and N_2 can be understood by relating their occurrence with various phases of source rock thermal maturity and migration into the reservoirs during different episodes of structuring. Deep-seated NNW-SSE faults in and around the structures are considered to be responsible for feeding non-hydrocarbon gases particularly CO_2 and hence their distribution may be predictable. This thesis also leads to infer that higher accumulations of inerts in one reservoir level may not be so in another reservoir level within same structure I field. Therefore, the areas previously assumed to be uneconomical due to their proximity to gas fields contaminated with inerts may actually hold good quality gas.